



Docket No.: 205109US20DIV

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

RE: Application Serial No.: 09/822,335
Applicants: Paul M. ENQUIST
Filing Date: April 2, 2001
For: SELF ALIGNED SYMMETRIC INTRINSIC
PROCESS AND DEVICE
Group Art Unit: 2814
Examiner: Ngan V. NGO

SIR:

Attached hereto for filing are the following papers:

REQUEST FOR RECONSIDERATION

Our check in the amount of \$200.00 is attached covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R. 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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205109US-20 DIV



#9 Response
M. Braunsch
10/29/02

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :
Paul M. ENQUIST : EXAMINER: Ngan V. NGO
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SIR:

Responsive to the Office Action dated May 17, 2002, please reconsider the above-identified application in light of the following remarks.

REMARKS

Favorable reconsideration of this application is respectfully requested.

Claims 40-76 are present in this application. Claims 40-47 and 49-76 stand rejected under 35 U.S.C. §102(b) or, in the alternative, under 35 U.S.C. §103(a) over U.S. 5,318,916 (Enquist et al.), and under 35 U.S.C. 103(a) over U.S. 5,247,192 (Nii). Claim 48 has been withdrawn from consideration.

Claim 51 was rejected under 35 U.S.C. 112, second paragraph, since it was found not to read on the elected species. The applicant agrees that claim 51 does not read on the elected species and thus withdrawal of this claim from consideration is appropriate.

Before addressing the prior art rejections, the applicant would like to provide the following brief discussion. The present invention is directed to a semiconductor device having active regions which are symmetrically self-aligned. The terms "symmetric" and "self-aligned" are attributes of the structure, and are not "process limitations." Self-alignment is the characteristic where a position of one element of the device is aligned another element of the device without any misalignment due to photolithographic tolerances. In some devices, alignment of elements can be critical to its performance. The misalignment or offsets due to the photolithographic tolerances may degrade the characteristics and limit the scaling of the device to a minimum feature size. Thus, a symmetrically self-aligned device structure is superior to a device having a structure where the elements are not self-aligned with each other, that is, the position of the elements are subject to being misaligned or offset due to the positions of the element not being determined in a self-aligned manner. A symmetrically self-aligned structure is different than a non-self-aligned structure, and the difference is not something that can be discarded by calling it a "process" element but the difference is manifested in the resulting structure. The resulting structure elements are not similarly aligned and the optimum device characteristics may not be obtained in the non-self-aligned device.

Turning to the rejection over Enquist et al., the Office Action refers to Fig. 11, and find region 70 to correspond to the first active region, region 101 to correspond to the second active region and region 12 to correspond to the third active region recited in claim 40. The Office Action states that Enquist et al. teaches that the first and second active regions (70 and

101) are “symmetrically self-aligned.” However, Enquist et al. only teaches that elements 70 and 101 are “symmetrically aligned.” There is never any assertion or any suggestion in Enquist et al. of a symmetrically self-aligned structure, in particular any self-alignment between elements 70 and 101.

Referring to column 8, beginning at line 37, a collector contact 60 is deposited on collector layer 11 symmetrically aligned with the emitter contact 31. This alignment is made photolithographically, and there is clearly no suggestion of the collector metal 60 being self-aligned to any structure in the device. The alignment of region 70 is determined relative to contact 60, as shown in Fig. 7. As element 70 is aligned relative to collector contact 60, there is no self-alignment between element 70 and the underlying collector 20, or 101.

In Enquist et al. there is a distinction made between what is self-aligned and what is not self-aligned. The base contacts 80 are described as self-aligned to the collector mesa 70 using collector metal contact 60 as a mask (see column 9, beginning at line 18). In this case the interior edges of the contact 80 are determined by contact 60, and the formation of collector mesa 70 is also determined by the contact 60. Mesa 70 and the interior edges of contacts 80 are self-aligned with respect to each other. Enquist et al. uses “self-aligned” in describing this relationship. When describing the relationship between elements 70 and 101, Enquist et al. clearly described this relationship as “symmetrically aligned.” There is no suggestion that these two elements are self-aligned. To the contrary, these elements are clearly not self-aligned since the position of element 70 is determined photolithographically and not self-aligned with another structure in the device, particularly element 101 or 20.

As Enquist et al. clearly does not disclose or suggest first and second active regions being symmetrically self-aligned as asserted in the Office Action, withdrawal of the rejection of claim 40 over Enquist et al. is respectfully requested.

The same situation exists with the rejection over Nii. In this reference, a mask is used to form opening 12 in which layer 2 is epitaxially grown. Subsequently, using the same mask, but in separate alignment and etching steps, opening 14 is formed by etching film 6 and 7. In other words, the alignment of opening 14 is determined by the second photolithographic and etching steps, and is not self-aligned to any structure in the device. The subsequently formed layers 3 and 4 thus have a position in the device determined by the second alignment and etching steps used to form opening 14. The alignment of layers 2 and 4 are thus not self-aligned, but are subject to misalignment and offset due to use of different photolithographic and etching steps to respectively form regions 2 and 4. There is further no assertion in Nii of self-alignment between regions 2 and 4. The Nii device structure suffers from the degradation of device characteristics and other limitations due to misalignments or offsets from using two different photolithographic and etching steps to determine the position of the elements of the device. As Nii does not disclose or suggest a self-aligned symmetric device, the withdrawal of the rejection of claim 40 over Nii must be withdrawn.

It should also be pointed out that a number of the claim elements in the dependent claims are not found in Nii, and there is also no discussion of these elements in the Office Action. For example, claim 44 recites the emitter having a narrow portion self-centered with a base and the collector having a narrow portion self-centered with a base and symmetric with the emitter. There is no discussion in the Office Action how Nii discloses or suggests these elements, and thus the rejection of claim 44 must also be withdrawn.

Claim 45 recites the base having a lower and upper ledge, and first and second base contacts formed on the upper and lower edges self-aligned with the emitter and collector, respectively. In Nii, contacts 8 to base region 3 do not contact upper and lower edges, nor are they self-aligned. The alignment of contacts 8 is determined photolithographically, and thus

there is no self-aligned position of the contacts in the device. Claim 47 also recites two base contacts formed on opposing sides of the ledges of the base, which is not disclosed or suggested in Nii. Claim 52 recites a first active layer having two portions with two different widths, claim 54 recites a second active layer having two different widths, and claim 56 recites first and second active layers having two different widths. None of this is suggested in Nii nor are any of the elements of claims 52, 54 or 56 identified in the Office Action.

Claim 57 recites a position of the first active region being self-centered with a position of the second active region in the device structure. In Enquist et al., there is no assertion of any self-centering of elements 70 and 101, or elements 70 and 20. These elements are only referred to as being symmetrically aligned, and there is clearly no assertion of any self-centering. The centering of element 70 is determined relative to contact 60, and the position of contact 60 is determined photolithographically. Thus the position in the device of element 70 is not self-centered with respect to element 101. Accordingly, the rejection of claim 57 over Enquist et al. must also be withdrawn.

The rejection of claim 57 over Nii must likewise be withdrawn because the centering of the region 4 is determined relative to the photolithographic and etching steps used to etch opening 14 which are different steps than those used to determine opening 12. Thus, the position of device element 4 is not self-centered with respect to a position of device element 2. The centers of the device are not self-aligned, but are aligned photolithographically which is subject to misalignment and offsets. As there is no suggestion of any self-centered elements as recited in claim 57 in Nii, withdrawal of the rejection of claim 57 is also respectfully requested.

Nii also does not disclose, nor is there any assertion of such disclosure, of the third active region of claim 65 where a contact is disposed on each side of the opposing plane

surfaces, claim 66 where the first active region has a width substantially equal to a width of the first contact, claim 73 where the third contact is disposed on a base having ledges on opposing surfaces, claim 74 where the third contact is disposed on the side and plane surfaces of the base region, claim 75 where the third contact is disposed on the side and the two opposing plane surfaces of the base contact. Clearly the rejection of these claims must be withdrawn since there is no suggestion of such structures in Nii.

It is respectfully submitted that the present application is in condition for allowance
and a favorable decision to that effect is respectfully requested.

Respectfully submitted,

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